REMARKS/ARGUMENT

The applicant's attorneys appreciate the Examiner's thorough search and remarks.

Responsive to the objection set forth in paragraph 1 of the Office Action, Figures 9 and 10 have been corrected. Approval of the corrected Figures and withdrawal of the objection is requested.

Claims 1-2 and 5-12 are in the application. Claims 1 and 12 are independent.

Claims 1 and 12 have been rejected under 35 U.S.C. §103(a) as obvious over Phy, U.S. Patent No. 4,688,075 in view of Nakabayashi, U.S. Patent No. 6,215,194.

Claim 1 calls for, in combination with other limitations:

> laying said thin flexible film on a thin semiconductor wafer of a second area, said semiconductor wafer being provided with a plurality of spaced apart semiconductor die, each of said semiconductor die having a respective third area which is substantially less than said first area;
>
> preheating said semiconductor wafer and said thin flexible film to partially cure said thin flexible film, thereby forming adhesion between said thin flexible film and said semiconductor wafer[.] (Underlying added.)

Claim 12 calls for, in combination with other limitations:

> laying a thin, flexible, polyimide, insulative film, which is separate from said wafer, and said wafer atop one another to form a film/wafer structure;
>
> preheating said film/wafer structure to partially cure said thin flexible film, thereby forming adhesion between said thin flexible film and said wafer[.] (Underlining added.)

Thus, in a process according to the present invention, a wafer and insulative polyimide film are laid atop one another and then heated to partially cure the polyimide film in order to attach the film to the wafer. See specification at page 4, lines 14-16. Phy, on the other hand, only states that "the rear major surface 100B of the wafer 100 (previously shown in FIG. 3A) is

attached to a first major surface 127A of conductive mounting media 127 which is preferably in the form of a tape." Col. 4, lines 31-35. Phy does not specify that the wafer may be attached to the polyimide film by laying the wafer and the polyimide film on top of one another and then applying heat to attach the two together. It appears, however, that Phy suggests using a type of film that already exhibits sufficient sticky characteristics as it states that "the conductive tape 127 should exhibit a release characteristic wherein it is relatively more strongly attached to the wafer 100 and less strongly attached to the carrier film 130" on which film 127 is carried. Col. 4, lines 41-45. By applying a method according to the present invention the use of "sticky" film may be avoided, which may be beneficial in reducing the cost of material in production or manufacturing control by eliminating a factor, (namely, the quality of the bond between the wafer and the film) which may affect the quality of the end product.

Furthermore, it has been set forth that Phy teaches "preheating said semiconductor wafer and said film to partially cured [sic] said film, thereby forming adhesion between said thin flexible film and said semiconductor wafer (see column 4, lines 50-55)". Office Action, page 3.

Phy states that in "the attaching of the tape 127 to the wafer 100, if the tape is a conductive polyimide, it is generally desirable to apply sufficient heating to encourage a strong attachment as well as to cause the polyimide to develop a desired electrical conductivity. Typically, this heating may be in the range of about 250°C. to about 375°C." Thus, Phy teaches that there should be sufficient heating to cause strong attachment and to develop electrical conductivity. There is no specific mention of partial curing as called for by the claims..

In addition, Phy teaches attaching the film to the wafer first and then heating the two to achieve a "strong attachment." Whereas, in a method according to the present invention, to attache the wafer to the film, the wafer and the film are laid on top of one another and then heated. Thus, in a method according to the invention, the heating of the wafer and the film is not a secondary step to achieve a stronger attachment, but is employed to achieve attachment of the wafer to the film in one step.

It has also been set forth that Phy teaches heating the wafer and the film to partially cure the film as called for by claims 1 and 12, followed by a final heating step to cure the film as described in col. 3, lines 39-45. Phy, however, teaches a heating step "in the range of about

250°C. to about 350°C.", col. 4, lines 54-55, to obtain a strong attachment, and then a heating step "in the range of about 250°C. to about 350°C.", col. 3, line 43, to attach the singulated die, which includes a layer of conductive polyamide media 27, to a substrate. That is, Phy appears to teach that the conductive polyimide film should be heated to a curing temperature twice. This is contrary to the subject matter of claims 1 and 12 which require a step for partial curing of the film prior to fully curing the film when the die is attached to a substrate.

Reconsideration of claims 1 and 12 in view of the foregoing is requested.

Claims 2 and 5-11 depend from claim 1, and, therefore, include its limitations. Each of these claims includes other limitations, which in combination with those of claim 1, are not shown or suggested by the art of record. Reconsideration is requested.

The application is believed to be in condition for allowance. Such action is earnestly solicited.

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as First Class Mail in an envelope addressed to: Asst. Commissioner for Patents, Washington, D.C. 20231, on April 7, 2003

Lawrence A. Hoffman
Name of applicant, assignee or Registered Representative

Signature

April 7, 2003
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Respectfully submitted,

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APPENDIX B

VERSION WITH MARKINGS TO SHOW CHANGES MADE
37 C.F.R. § 1.121(b)(iii) AND (c)(ii)

CLAIMS:

1. (Twice Amended) A process of connecting semiconductor die to a substrate having a top surface,

said process comprising the steps of:

providing a thin, flexible, heat curable, polyimide, insulative film which is of a first area;

[placing] laying said thin flexible film on a thin semiconductor wafer of a second area, said semiconductor wafer being provided with a plurality of spaced apart semiconductor die, each of said semiconductor die having a respective third area which is substantially less than said first area;

preheating said semiconductor wafer and said thin flexible film to partially cure said thin flexible film, thereby forming adhesion between said thin flexible film and said semiconductor wafer;

thereafter simultaneously singulating both said thin flexible film and said plurality of identical semiconductor die to form individual elements;

heating said substrate;

thereafter placing at least one of said singulated semiconductor die on the top surface of said heated substrate with the thin flexible film on said die pressed against said top surface and adhered thereto; and

thereafter heating said semiconductor die and said substrate to a curing temperature to fully cure said thin flexible film to firmly adhere said semiconductor die to said substrate.

12. (Twice Amended) A method of manufacturing a semiconductor device comprising the steps of:

providing a wafer with a plurality of spaced apart semiconductor elements;

[placing] laying a thin, flexible, polyimide, insulative film, which is separate from said wafer, and said wafer atop one another to form a film/wafer structure;

preheating said film/wafer structure to partially cure said thin flexible film, thereby forming adhesion between said thin flexible film and said wafer;

singulating said film/wafer structure with said partially cured thin flexible film, thereby forming a plurality of individual semiconductor dies;

heating said substrate;

placing at least one individual semiconductor die with said partially cured thin flexible film, which faces a substrate, on the said heated substrate; and

applying heat to fully cure said thin flexible film, thereby bonding said individual semiconductor die with said substrate.